

R E P O R T

ON THE

IMPROVEMENT OF THE HARBOUR OF

A R K L O W,

AND THE PRACTICABILITY OF A

N A V I G A T I O N

From thence by the Vales of the various Branches of the

O V O C A.

PUBLISHED BY ORDER OF THE SUBSCRIBERS.

By WILLIAM CHAPMAN, ENGINEER. *CE* *X*

D U B L I N :

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M,DCC,XCII.

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DUBLIN:

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R E P O R T
O F
William Chapman, Engineer,
O N T H E
H A R B O U R O F A R K L O W,
*And Practicability of Interior Navigation from thence
through the County of Wicklow.*

HAVING examined the Harbour of Arklow with a view to its improvement, and the possibility of extending a Navigation from thence into the mountainous county of Wicklow, I now proceed to give my sentiments on these subjects, and to point out their consequences to the Public.

The natural disadvantages of this Harbour, are the small flow of tide, *only from 18 inches to 4 feet*, which prevents its receiving the benefit it otherwise would do, from its influx and efflux; and also the *tendency of the outlet to advance along the coast to the northward*; and to be extended in its opening, and consequently shallow.

From these causes the Harbour is at present only accessible to small sloops on spring tides, and no further than the point of the Sand Hills, a quarter of a mile below the town.

Arklow is at present a considerable place; and to enable it to rise into opulence, and mutually serve, and be served by the interior country, it is necessary that a new and unchangeable Outlet be made; and that deep water should, as far as possible, be brought up to the town itself.—These purposes, I conceive, may be effected by the following means, which will be more clearly understood by referring to the plan, viz. *by making a new Outlet corresponding with the direct course of the river;—by confining that Outlet on its northern side;—by stopping up the old channel as near as convenient to the sea;—by lowering the pavement of 5 or 6 arches;—by fixing sluices at the bridge;—and lastly, by stopping up the south end of the N. E. channel of the harbour, and opening the passage formerly closed near the bridge.*

Having mentioned what has to be done, it now remains for me to explain the motives and probable effects.

It has been suggested, and is the prevailing opinion, that the only means of improving the Harbour, would be to cut a new channel to the Rock and discharge it there; but, against this idea there are very sufficient reasons; *the vast expence of cutting a deep channel for near a mile; and, when at the Rock, the shallow water, twice as extensive from the shore as at the proposed outlet; and finally the increased distance of the Harbour from the town.*—In favour of the plan designed, there is absolute experience, from the river having, a few years since, in a violent flood, forced itself out in a direct course, and scoured out a channel down to the marle, or about 15 feet below high water; which channel was kept open until the natural causes that formerly drove it to the northward, and the want of a strong current to keep it deep, caused it to assume its present direction and shoalness.

The

The chief agent in keeping open the bar, is, excepting in time of land floods, the N. E. inlet within the marshes, which receives in every spring tide, on an average, 3 feet depth on about 2750 superficial perches, equal to about 103,000 tons, all the force of which may be made to operate in cleansing the River from the town downwards, *by closing the south channel of the inlet, and opening the passage near the bridge as already mentioned.*

The pavement under the bridge is so high, that the spring tides only flow over it; and above the bridge there is a bar, keeping the water dead for about a mile, over which the highest tides only flow a few inches, but of course raise the whole River to that extent.

The quantity of water, yielded by all the branches of the Ovoca, was in the middle of September, when the season was dry, nearly 12,000 cubic feet per minute, or about 20,000 tons an hour; which in scouring the harbour on an ebb tide must have a material effect. Now the superficial area of the river, from above the bridge to where the highest tide ceases to flow, is about 1600 perches; which at 3 feet depth, to which it may easily be drawn down, contains 60,000 tons:—therefore, if the shoals opposing the exit of this depth of water, be removed, which may easily be done; and means be taken to keep the water up, and discharge it at any period; it follows that being let off in the last two hours of ebb, the current of the river will for that space of time be more than doubled *, and the good effects of a considerable land-flood be produced at pleasure, without any of its inconveniencies; which are the bringing down, from the high gravel banks bounding the River, a great deposit of that substance to the Harbour's mouth. By these means, the efficacy of which has been sufficiently proved in various Harbours, and by that of Ramsgate in particular, there can be no doubt of a great depth over the bar; *provided the Outlet be properly*

* In summer more than trebled.

properly directed, which I propose to be done by a jetty on the N. E. side only; the tendency of the sand to go to the northward*, being apparently sufficient to contract the entrance of the Harbour, which is an essential requisite to the obtaining of depth.

The cheapest mode of carrying out this jetty would be on a foundation of loose stones to above the water's edge; but, besides other inconveniencies, this method is not adapted to Harbours of narrow entrance; because vessels cannot keep sufficiently clear of the extensive base of the work. The method I have founded the estimate upon, as the cheapest and best under the local circumstances of the Harbour, is to run from a little below low water mark, a front piling to about half way within the beach, rounding off its inner end to the N. E. Behind this piling, which, exclusive of a slope inwards, must be secured by land tyes, a quantity of stones should be laid; which, on the new channel being opened, will progressively find their way down.

On these, when fully subsided, a double † wall or pier should be built—Beyond which, to keep the Outlet in its proper direction, and prevent the River losing its scouring force, I recommend a line of carcasses, or triangular prisms, filled with stones, to be laid from the pier head to the deep water.

Having now described the works of the Harbour, I shall proceed to the interior navigation, which, *on account of the declivity of the ground through which the Canal must pass*, and also the rapid rise which has to be surmounted to go even a moderate distance into the country, does not favourably admit of being entirely carried on by the usual means.

The

* If the event prove otherwise, a Jetty must then be built on the south side.

† Where not exposed to the sea, a front facing only.

The steep face of the hills the Canal has to run along will necessarily confine its width, and produce a similar effect on the width and depth of the boats; which will likewise, in a certain degree, be limited in length by the necessity of quick curves round the points of the hills.

Their dimensions I recommend to be 7 feet width on the gunwale, 5 feet at the bottom, 3 feet 6 inches depth, and about 40 feet extreme length,—If properly built they will carry upwards of eight tons each at 2 feet draught of water, and about 11 tons at 2 feet 6 inches.

The size of Canal suitable to them should be 18 feet on the water line where the banks are steep, and in favourable ground 21 feet, to admit two laden boats to pass; where not regularly so, it must be at convenient distances made that width, for the length of a couple of boats. Where 21 feet wide, 3 feet 6 inches depth of water will be sufficient, and where narrower it should be deeper; for, wherever the section of the Canal approaches nearly so low as *only 3 to 1 of that of the boat*, considerable inconveniencies arise both from the increased resistance of the boat, and the damage to the banks *from the counter current to fill up the space the boat leaves in her rear*.—In the proportion mentioned of 3 to 1, the increased resistance to any usual rate of going will be nearly $2\frac{1}{4}$ times what it would be in open water; and the counter current along the banks will run with half the rapidity the boat goes along the land; from which may be conceived the tendency of narrow Canals *to fill up by the washing in of their banks*; and that *the tracking against a moderate current in an open River*, requires less force than the moving in such a Canal; besides possessing the advantage of favouring the boats in going downward.—These circumstances I chiefly mention, because the Navigation I shall recommend, will be a considerable distance in the River.

The ships using the port of Arklow must of course lie below the bridge; and, as in many instances, it will be necessary for the boats to have a communication with them *without*

without waiting for the tide, a Lock becomes requisite at the bridge *, to rise to half tide height ; or whatever may be necessary to give at least 2 feet 6 inches water to the point of junction with the Canal, which I conceive will most conveniently be at Poolahoney-Brook, above the first and second Rapids, which may be surmounted by contracting the current to give depth. The distance from the bridge to this point is a few perches more than a mile and an half. Here the boats should ascend a double Lock of about 22 feet rise; and after skirting the foot of the hill to near the rocky point in Kilcarra, and ascending a second similar Lock, the level may cross the Aughrim River on an aqueduct, immediately below the wooden bridge, to *the foot of the hill fronting the fork of the Rivers.*—The whole distance from Arklow bridge to the foot of this hill is 3 miles and 5 furlongs ; and here, to suit the junction of the Rivers Avonmore and Avonbeg, the line should ascend about 55 feet, which is estimated to be done by a staircase of Locks. Having gained this elevation, it evidently follows, that a line may branch off towards Aughrim, and continue till intercepted by the River ; where that may be, I am ignorant of, from its not having been surveyed ; but it ought to cross the River between Aughrim and Rudenagh, as then by a third ascent a Canal may approach Hacketstown.—As the Northern Line is now laid out, it passes the great copper mines of Ballymurtough and Cronebawn, and terminates at the junction of Avonmore and Avonbeg, from whence it will receive its supplies ; and if the Eastern bank of Avonmore be practicable for a narrow Canal, the boats may then, by a Guard Lock, enter and cross that River, and by an ascent *suitable to the ground*, run on to, or pass the bridge of Rathdrum ;
by

* Left it may be thought that the projected works at the bridge may retard the passing off of the floods, or endanger the bridge itself, I must observe, that the sluicing passages in the arches, where the pavement has to be lower'd, will be secured by aprons at their feet ; and the stops in the other arches, and likewise the sluices, may all be so constructed as to open of themselves whenever a flood rises, and consequently the water have a more open passage than ever.

by which means that town, would reap such advantages as would undoubtedly tend to its increase; and, exclusive of that cause, add to the value of the lands, from the certain and easy conveyance of their produce to the sea, and return of manure * from that quarter.

Those acquainted with the county of Wicklow may reasonably object to the practicability of extending the Navigation far into the country, either towards Rathdrum or Hacketstown, on account of the vast ascent, which would be too expensive to overcome totally by Locks; but on reflecting that the steep and winding face of the hills necessarily confines to the use of small boats, and that there are situations for ascending at once 70 or 80 feet, or whatever heights may be necessary to penetrate far into the country, the difficulty will vanish, if these heights can be surmounted at a moderate charge.

Methods of effecting this have long been talked of and attempted, and lately have been successfully carried into effect at Colebrook Dale, where boats of 8 tons are passed up and down a fall of 70 feet, in less time than they would pass a double Lock.—This is done by two parallel framed ways of timber, on which two strong carriages alternately pass up and down with boats on them:—The ascending boat floats directly upon its carriage, at the end of the lower level; and the upper one, after entering a Lock, alights upon its carriage, which, after the lower gate of the Lock is opened, is ready to move †.

This

* From Sutton Creek, and other places where limestone is convenient.

† This method of removing boats from level to level differs essentially from the late Mr. Dukart's unsuccessful attempts at Dunganon—He neither made use of upper locks or carriages.

Another method of passing heavy articles from one level to another, by means of inclined planes, and in various cases very eligible, was invented by a Mr. George Dixon, of Cockfield, in the county of Durham; who, sometime prior to the year 1780, proposed

This may suffice for the general principles; the minutiae would be too tedious to explain here, and are besides unnecessary, as the practicability has been ascertained beyond a doubt, from being successfully carried into effect.

The same boats as recommended for the lower Navigation will do for this, excepting that they ought not to be so long, to avoid straining; they may, however, with safety be nearly 30 feet extreme length, and in other respects the same.—At 28 feet extreme length they will, with ends sufficiently sharp, carry nearly 6 tons at 2 feet depth, and upwards of 8 tons at 2 feet 6 inches.

Having now finished what I have to say as to the practicability, I shall recapitulate the advantages that may be expected from carrying those works into execution.

A great inconvenience to the Navigation of the Irish Channel is the *want of a harbour south of Dublin, there being none short of Waterford fit for a vessel of burthen*; therefore, if Arklow be made accessible for such vessels, it may be the means of saving many from shipwreck, and of affording shelter to a greater number, with an advantage almost peculiar to itself, *of admitting them nearly equally at all times of tide*; thus, as in almost all other cases, what is attended with inconvenience, is accompanied with some counterbalancing benefit.—As a place of refuge, the harbour will be useful to the whole Navigation of the Channel;—and, aided by the projected Canals, will prove to the county of Wicklow a source of immediately great, and progressively increasing advantage, by affording a ready conveyance to every market domestic and foreign, of all the products of

posed that a Canal should be made along the foot of a range of high ground containing collieries, from which waggons were to be run on to the decks of boats, and conveyed to a general rail-way, communicating by a further declivity with an intended Navigation, where the coals were to be discharged into other boats.

of the country * ; and by fertilizing the surrounding lands, through the ready and cheap conveyance of limestone and coals to the glens and mountains that now remain in a state of nature, or only half improved, from the excessive dearth of lime.---And, lastly, by the cheap carriage of the copper-ore of the mines of Cronebawn and Ballymurtough, enable the proprietors to work them extensively ; and, consequently, give employment to great numbers, and raise the value of the adjacent estates, by finding on the spot immediate demand and consumption for all the smaller products of the farm.

When to the interest the Public must feel, and the great local advantage of the landed proprietors, we take into consideration that all these benefits may be produced by means scarce one half as expensive as the usual methods of penetrating so far, and ascending such heights, in countries favorable for the common style of Navigation ; the conclusion must naturally be that the inducements to carry the proposed works into execution are sufficiently great.

I should here observe, that part of the plan of Navigation proposed, is *only applicable to mountainous countries* ; which enjoy this peculiar advantage, that if *the rise of level be made on a point dividing two Rivers*, the ascent enables both valleys to be navigated.

This mode of Navigation has its limits in point of eligibility, and in general, where extensive, must be a mixed one ; for where the ground from gentle declivity, requires small falls, they should be ascended by Locks ; which for such boats as described, may be built at a comparatively low expence.

It now remains for me to shew the cost attendant on the carriage of articles by these means.---The boats, I have
previously

* This may even extend to the county of Carlow, as Hacketstown may be easily approached through the deep valley below Sandyford, by the branch recommended after crossing the arm of the
river

previously said, should carry nearly 6 tons *, but I will only estimate them at 5.

The boats may go in pairs; and, after the manner practised on the Lincolnshire Rivers, the one boat may act as a rudder to the other; then, if navigated by two † Men each, there will be three men to track, and one to steer; in which case they may travel 10 miles a day, and discharge their cargoes.—Estimating the charge of these men at one shilling a day each, and admitting them to return empty, we shall find the conveyance of 10 tons, the cargo of the two boats, the distance of ten miles to stand only to 96d. not quite one penny per ton, per mile; therefore the rate of freight ‡, the tolls being the same, may be as low as on any other Navigation in the kingdom, which is the chief desideratum to be sought for.

Dublin, 6th Dec. 1791.

WILLIAM CHAPMAN.

river between Aughrim and Rudenagh; which level, as in the one at the wooden bridge, might, if necessary, branch up both forks.

Between the rivulet of Sandyford and some of the branches of the Deeren, there is a line of flat ground, after crossing which, a Canal following the level of the country may pass above Hacketstown, and probably all the way to Baltinglass. And, wheresoever this level may cross the river Slaney, it may be extended to near Carlow, and thus supply the county of Wicklow with lime and coal from each extreme.

* By loading them to 2 feet 6, which may be done if the River part of the Navigation admit of it (and it may do so by little attention in dredging) the boats will, as already mentioned, carry upwards of 8 tons, but then a Horse and 2 men will probably be required to a pair of boats.

† In short distances, it will be best to track with Men, because of their use in loading and delivering; but, if the Navigation be extended far into the country, Horses will become eligible, and the expence of Navigation less in proportion to the distance.

‡ The usual freight charged by the Boat-Owners on the Grand Canal, is two pence per ton per mile, exclusive of the charge of tolls.

Estimate of the Improvement of Arklow Harbour.

	£.	s.	d.
A Jetty bounding the North Side of the New Outlet, and projecting 80 Yards into the Sea, -	1920	10	0
Opening the New Passage, - - -	50	0	0
Stopping the present Sea Channel, - - -	160	0	0
Stopping the South Channel to the Creeks, and opening a Passage near the Bridge, - - -	190	0	0
Lowering the Pavement near the Bridge—Cost of Sluices, &c. - - - - -	608	0	0
Dredging Passages above Bridge to admit the River to fill and empty with the Tide, - - -	80	0	0
Wharfs and Harbour Master's House, -	300	0	0
Machinery, Pile Engines, Floats, &c. -	200	0	0
	3508	10	0
Superintendence and Incidents on Water-Work, 20 per Cent. - - - - -	701	14	0
Total Estimate of Harbour -	4210	4	0

INTERIOR NAVIGATION.

Estimate of the River Navigation from Arklow Bridge to Poolahoney Brook.

Miles.	Perc ^{ts} .		£.	s.	d.	£.	s.	d.
		Lock at the bridge & Lock House, -	530	0	0			
		Flash Weirs at the two Rapids below Poolahoney, and dredging the Shoals, - -	230	0	0			
I	160	Superintendence and incidents on Water Works, 20 per Cent. - - - -	152	0	0			
						912	0	0

Estimate of the proposed Canal from quitting Poolahoney Brook, to the foot of the hill after passing Aughrim River below the Wooden Bridge.

		Cutting and Embanking 675 Perches (80 through Rock) with Back Drains, - -	1472	0	4			
		Two Double Locks of nearly 22 feet fall each & Lock Houses,	1860	0	0			
		An Aqueduct of three Arches of 78 feet						
2	40	Water Way, - -	1500	0	0			
		3 Communication Bridges at 50l. -	150	0	0			
		4 Small Tunnels at 35l. -	140	0	0			
		2 Overflows, - -	60	0	0			
		Stop Gates on each side the Valley, -	48	0	0			
		Keeping dry the foundation of Poolahoney Lock, - - - -	40	0	0			
			5270	0	0			
		Superintendence & incidents 15 per Cent.	790	10	0	6060	10	0
3	200	Carried over				6972	10	0

Miles. Perches.

3 200

Brought over

£. s. d.
6972 10 0

Estimate of the proposed Canal,
from the Wooden Bridge to
the Meetings Bridge.

		Cutting and Embank- ing 1140 Perches, with Back Drains, Lock Pits, and 340 Perches of new high Road, - - - -	£. s. d.
			2466 8 4
3	173	A Stair Case of 6 Locks with side Reservoirs to the third Fall; and Lock House, -	2630 0 0
		5 High Road Bridges, at 70l. - - -	350 0 0
		4 Communication Bridges, at 50l.	200 0 0
		2 Overflows, - -	60 0 0
		1 8 Foot Tunnel, -	150 0 0
		11 Drainage Tunnels, at 25l. - - -	385 0 0
		Weir & Guard Sluice,	120 0 0
7	55	Superintendence and in- cidents 15 per Cent.	6361 8 4
			954 4 3

7315 12 7

L A N D.

1	160	On Bank of River, at an average width of $\frac{3}{4}$ of a Perch, -	Ars.	Rds.	Perches.
			2	1	0
5	215	Of Canal, at an aver- age width of three Perches, - - -	34	0	5
			36	1	5
7	55	At 25l. per Acre, on Total Estimate of Interior Naviga- tion, - - -			

906 5 0

15194 7 7

2000

310

Item	Quantity	Unit Price	Total
Superintendence and in-	1	\$25.00	\$25.00
stallment 12 per cent	1	\$25.00	\$25.00
Well & Guard House	1	\$150.00	\$150.00
at 150	1	\$150.00	\$150.00
11 Drainage Trenches	11	\$15.00	\$165.00
18 Foot Trench	1	\$150.00	\$150.00
2 Overflows	2	\$50.00	\$100.00
Drainage, at 50	2	\$50.00	\$100.00
4 Communication	4	\$25.00	\$100.00
at 25	4	\$25.00	\$100.00
5 High Road Bridges	5	\$100.00	\$500.00
1 each House	1	\$100.00	\$100.00
with the Robinson	1	\$100.00	\$100.00
A Star Gate of 8 Locks	1	\$100.00	\$100.00
Road	1	\$100.00	\$100.00
Purchase of new high	1	\$100.00	\$100.00
Locks 25 and 30	1	\$100.00	\$100.00
with Back Dam	1	\$100.00	\$100.00
ing 1140 Pitches	1	\$100.00	\$100.00
Casting and Fencing	1	\$100.00	\$100.00

7 20 2487

On Bank of River at	10	00	00
and 1/2 of a Field	10	00	00
Of Canal, at an aver-	10	00	00
age width of three	10	00	00
Feet, - - - - -	10	00	00
At 1/2 per Acre, on 25	10	00	00
Total Estimate of Interest	10	00	00

0 2 300

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